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PN - JP10050523 A 19980220
TI - IMPEDANCE DEVICE AND ITS MANUFACTURE
FI - H01F15/00&D ; H01F17/00&B
PA - TOKIN CORP
IN - TAMURA MITSUO
AP - JP19960215343 19960726
PR - JP19960215343 19960726
DT - I

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AN - 1998-199132 [18]
TI - Laminated impedance element for EMI countermeasure of electronic device - has membrane with electrically conductive substance, laminated on surface of multilayer body and baked by which it is connected with ends of spiral coil in parallel manner
AB - J10050523 The element includes a spiral coil (1) laminated alternately and enclosed by a magnetic substance (2). The magnetic substance includes ceramic paste containing magnetic oxide material, a metal powder and a conductive paste, while the coil is only made of conductive paste.
- Then, the multilayer body is baked. A resistance element comprising a membrane of electrically conductive substance is then laminated on the surface of the multilayer body and is again baked. Thus, the resistance element is connected with the ends of the coil in parallel manner.
- ADVANTAGE - Controls impedance value, easily in specific high frequency area.
- (Dwg.4/8)
IW - LAMINATE IMPEDANCE ELEMENT EMI ELECTRONIC DEVICE MEMBRANE ELECTRIC CONDUCTING SUBSTANCE LAMINATE SURFACE MULTILAYER BODY BAKE CONNECT END SPIRAL COIL PARALLEL MANNER
PN - JP10050523 A 19980220 DW199818 H01F17/00 006pp
IC - H01F17/00 ; H01F27/00
MC - V02-F01 V02-F03 V02-G02 X12-C01
DC - V02 X12
PA - (TOHM) TOKIN CORP
AP - JP19960215343 19960726
PR - JP19960215343 19960726

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AB - PROBLEM TO BE SOLVED: To provide an impedance device which can easily control the impedance to a target value in a specified high-frequency region, without distinction of shape and whose magnetic material can be used for components of different impedance value and to provided method for manufacturing the same.
- SOLUTION: A magnetic substance 2 is formed by laminating alternately ceramic paste of oxide magnetic powder and conductive paste of metallic powder. Spiral coils 1 of conductive paste are formed in the magnetic substance 2 and fired in one piece to form a multilayer component. A resistor device of a film of conductive substance formed on the surface of the multilayer device and n impedance device connected in parallel to the ends of the spiral coils are formed.
I - H01F17/00 ; H01F27/00
PA - TOKIN CORP
IN - TAMURA MITSUO
ABD - 19980430
ABV - 199806
AP - JP19960215343 19960726

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-050523

(43)Date of publication of application : 20.02.1998

(51)Int.Cl. H01F 17/00
H01F 27/00

(21)Application number : 08-215343

(22)Date of filing : 26.07.1996

(71)Applicant : TOKIN CORP

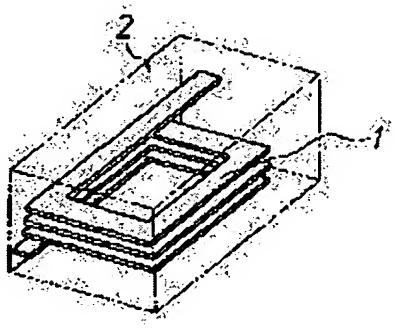
(72)Inventor : TAMURA MITSUO

(54) IMPEDANCE DEVICE AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an impedance device which can easily control the impedance to a target value in a specified high-frequency region, without distinction of shape and whose magnetic material can be used for components of different impedance value and to provided method for manufacturing the same.

SOLUTION: A magnetic substance 2 is formed by laminating alternately ceramic paste of oxide magnetic powder and conductive paste of metallic powder. Spiral coils 1 of conductive paste are formed in the magnetic substance 2 and fired in one piece to form a multilayer component. A resistor device of a film of conductive substance formed on the surface of the multilayer device and n impedance device connected in parallel to the ends of the spiral coils are formed.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] the ceramic paste which consists of an oxide magnetic material -- a laminating -- carrying out -- a it top -- said ceramic paste and conductor -- the impedance component which carries out the laminating of the ** paste by turns, forms a conductor in a spiral coiled form, carries out the laminating of said ceramic paste on it, and is characterized by to connect to the coat which consists of conductive material which made the layered product, calcinated this layered product, and was formed in the front face of this layered product, the both ends of a spiral coil, and juxtaposition.
[Claim 2] The manufacture approach of the impedance component characterized by forming the film which is made to return partially the front face of the component which consists of a sintered compact of an oxide as means forming of a coat according to claim 1, and has predetermined conductivity.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to few laminating mold impedance component and its manufacture approach of distortion of a signal wave, or delay for the purpose of the noise absorption in a signal circuit.
[0002]
[Description of the Prior Art] Generally inserting an impedance component in a serial as the technique of the cure against EMI of electronic equipment at a signal system, and intercepting a noise in recent years is performed.
[0003] Moreover, controlling that insert an impedance component in a serial and the noise of a signal system is revealed to power-source Rhine from an AKUCHIBU component also to power-source Rhine systems, such as power amplification, is also performed.
[0004] However, as for the cure against EMI by the impedance component, the effectiveness of minus that a reactance component gives distortion to a signal wave form, or produces the delay of a phase is also accepted.
[0005] The impedance Za of an impedance component is composition of the resistance component Ra of real part, and the reactance component Xa of imaginary part, and is expressed with the formula of Ra+jXa. It is effective in noise absorption and the ideal impedance component which produces neither distortion nor phase lag is the specific RF field which has a noise component, the resistance component Ra of real part shows a big value, and the resistance component Ra of real part and the reactance component Xa of imaginary part have the frequency characteristics which show a small value in the cycle field of a signal region.
[0006]
[Problem(s) to be Solved by the Invention] A specific value is required by the circuit where the resistance in the RF field which acts on noise absorption is used again. Although the component used for this purpose is realized by adjustment of the frequency characteristics of the loss of a proper which a magnetic material has, and the number of turns of the spiral coil formed etc. as a means put close to desired frequency characteristics today, the loss property which an ingredient like a ferrite has has a low degree of freedom, and that the target frequency characteristics are not necessarily acquired poses a problem.
[0007] The technical problem of this invention can control an impedance value by the specific RF field easily to the target value, and is to offer the impedance component which one magnetic material can share for the component of various impedance values, and its manufacture approach.
[0008]
[Means for Solving the Problem] the ceramic paste with which this invention consists of an oxide magnetic material -- a laminating -- carrying out -- a it top -- said ceramic paste and conductor -- it is the impedance component which carries out the laminating of the ** paste by turns, forms a conductor in a spiral coiled form, carries out the laminating of said ceramic paste on it, and is characterized by to connect to the coat which consists of conductive material which made the layered product, calcinated this layered product, and was formed in the front face of this layered product, the both ends of a spiral coil, and juxtaposition.
[0009] Moreover, this invention is the manufacture approach of the impedance component characterized by forming the film which is made to return partially the front face of the component which consists of a sintered compact of an oxide as means forming of the above-mentioned coat, and has predetermined conductivity.
[0010]

[Embodiment of the Invention] The gestalt of operation of this invention is explained using a drawing.
[0011] Drawing 1 shows the parallel circuit of an inductance L and Resistance R. The impedance between the terminals of this circuit is given by ** formula.
[0012]
Z=(omega2L2 R+jomegaLR 2)/(R2+omega 2L2) ..... ** [0013] the impedance component of this invention -- a ceramic paste and a conductor -- the target frequency characteristics can be acquired by carrying out the laminating of the ** paste by turns, forming a conductor in a spiral coiled form, carrying out the laminating of said ceramic paste on it, making a layered product, calcinating this layered product, forming in the front face of said layered product the coat which consists of conductive material of a resistance element, and considering as the compound device which connected this coat and the both ends of said spiral coil to juxtaposition.
[0014] When the value of the inductance L of said circuit is set to 1 microhenry or 2 microhenries and the value of the resistance R of said circuit is set to 500 ohms, the frequency characteristics of the impedance Z1 between both-ends children and the resistance component R1 of the real part, and the reactance component X1 of imaginary part are respectively shown in drawing 2 in order as a curve of A1, B1, C1, D1, E1, and F1.
[0015] The resistance R of a circuit is 500ohms and A1 shows the frequency characteristics of the impedance Z1 in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 500ohms and B1 shows the frequency characteristics of the resistance R1 of real part in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 500ohms and C1 shows the frequency characteristics of the reactance component X1 of imaginary part in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 500ohms and D1 shows the frequency characteristics of the impedance Z1 in case in DAKUNSU L of a circuit is 2 microhenries. The resistance R of a circuit is 500ohms and E1 shows the frequency characteristics of the resistance R1 of real part in case in DAKUNSU L of a circuit is 2 microhenries. The resistance R of a circuit is 500ohms and F1 shows the frequency characteristics of the reactance component X1 of imaginary part in case in DAKUNSU L is 2 microhenries.
[0016] When the value of the inductance L of said circuit is set to 1 microhenry or 2 microhenries and the value of the resistance R of said circuit is set to 300 ohms, the frequency characteristics of the impedance Z2 between that each child of both ends and the resistance component R2 of the real part, and the reactance component X2 of imaginary part are respectively shown in drawing 3 in order as a curve of A2, B-2, and C2, D2, E2 and F2.
[0017] The resistance R of a circuit is 300ohms and A2 shows the frequency characteristics of the impedance Z2 in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 300ohms and B-2 shows the frequency characteristics of the resistance component R2 of real part in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 300ohms and C2 shows the frequency characteristics of the reactance component X2 of imaginary part in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 300ohms and D2 shows the frequency characteristics of the impedance Z2 in case in DAKUNSU L of a circuit is 2 microhenries. The resistance R of a circuit is 300ohms and E2 shows the frequency characteristics of the resistance component R2 of real part in case in DAKUNSU L of a circuit is 2 microhenries. The resistance R of a circuit is 300ohms and F2 shows the frequency characteristics of the reactance component X2 of imaginary part in case in DAKUNSU L of a circuit is 2 microhenries.
[0018] In a low frequency field, the impedance value of a coil part with a low impedance value becomes dominant, the impedance value between 2 terminals is decided so that clearly from drawing 2 and drawing 3 , but if it becomes a RF field and the impedance value of an inductance comes to exceed resistance of a circuit, the resistance component of real part will become dominant and the impedance value between 2 terminals will be converged on the value of the resistance component of real part.
[0019] Moreover, it is also possible to give change to the standup of an impedance value with the frequency characteristics of an impedance value with an inductance value.
[0020] By the way, if a magnetic material like a ferrite is used for a core and an impedance component is produced, with the rise of a frequency, a reactance component will decrease and loss will increase to coincidence.
[0021] As a result, the frequency characteristics of an impedance value show change similar to the above-mentioned pure inductance L and the frequency characteristics of the parallel circuit of Resistance R.
[0022] However, when acquiring desired frequency characteristics, what controls frequency characteristics has the main loss property of an ingredient, others have few degrees of freedom at the number of turns of a spiral coil, and inductance value extent by configuration adjustment, and the target frequency characteristics are not necessarily

acquired.
[0023] However, when resistance is connected to this inductance component and juxtaposition, the effectiveness by connecting with resistance and juxtaposition is shown, the component of the real part of the impedance in a RF field can control the component of the real part of an impedance, and it becomes possible to control the resistance of a RF field very easily.
[0024] However, in the miniaturization of components, or a surface mount activity, it is not desirable to newly add a resistance element in respect of the increment in a man day. If it is possible to form a resistance element in the front face of an inductance component, offer of the impedance component which is extremely rich in practicality will be attained.
[0025]
[Example] The example of this invention is explained.
[0026] The powder of a nickel-Cu ferrite was prepared as ceramic powder. This powder was blended with the binder and the solvent by the ratio of Table 1, respectively, and the ceramic paste which kneads a compound with 3 rolls and consists of an oxide magnetic material was produced.
[0027]
(表1)

セラミックペーストの配合	
成　　分	配　合
酸化物磁性粉末（Ｎｉ－Ｃｕフェライト）	１００重量部
エチルセルロース樹脂	５重量部
エチルセルソルブ	１００重量部
テルピネオール	５０重量部

[0028] a conductor -- the mixed powder (Ag70%, Pd30%) with a mean particle diameter of 0.5 micrometers of Ag and Pd was prepared as ** powder.
[0029] this powder -- the ratio of Table 2 -- a binder and a solvent -- blending -- 3 rolls -- kneading -- a conductor -- the ** paste was produced.
[0030]

(表2)

導体用ペーストの配合	
成　　分	配　合
銀パラジュウム粉末	１００重量部
ポリビニルブチラル樹脂	２０重量部
シクロヘキサン	１００重量部
トルエン	５０重量部

[0031] Next, the laminating of the produced ceramic paste was carried out to 500 micrometers in predetermined thickness by print processes. besides -- a ceramic paste and a conductor -- using the ** paste, the spiral coil of the conductor of 3.5 turns was formed, the laminating was performed one by one, and the laminating of the ceramic paste was carried out by 300-micrometer print processes on this.
[0032] After it cut the layered product which carried out [above-mentioned] production in the predetermined dimension (2.4mmx1.5mm) and it degreased this, it was really calcinated at 950 degrees C. Drawing 4 shows the internal structure of the component which consists of this coil 1 and magnetic substance 2. The conductive paste which is mainly concerned with Ag was applied to the field which the lead section of a coil 1 has exposed, and it considered as the external terminal. The component of this condition was made into Sample A.
[0033] Next, after vapor-depositing carbon thinly on the ceramic front face between electrode terminals, what adjusted the direct current resistance between terminals to 180 ohms with the trimming equipment was made into Sample B, measuring resistance using a direct-current-resistance meter.
[0034] Moreover, about the thing in which the external terminal was formed, it put into the tube furnace and heat treatment for 700 degree-Cx 30 minutes and, and 10 minutes was performed in the hydrogen ambient atmosphere. About this sample, when the direct current resistance between terminals was measured, 480 ohms and 970-ohm resistance were checked, respectively. This was made into Samples C and D.
[0035] The frequency characteristics of the impedance of the laminating inductor produced as mentioned above were evaluated using impedance analyzer HP4191made from YHP A. The result of Sample A, Sample B, Sample C, and Sample D is shown in drawing 5 , drawing 6 , drawing 7 , and drawing 8 , respectively.
[0036] As shown in drawing 5 , ZA shows the frequency characteristics of the impedance ZA of the sample A when not adding a resistance element. RA shows the frequency characteristics of the resistance component RA of the real part of the sample A when not adding a resistance element. XA shows the frequency characteristics of the reactance component XA of the imaginary part of the sample A when not adding a resistance element.
[0037] As shown in drawing 6 , ZB shows the frequency characteristics of the impedance ZB of Sample B. RB shows the frequency characteristics of the resistance component RB of the real part of Sample B. XB shows the frequency characteristics of the reactance component XB of the imaginary part of Sample B.
[0038] As shown in drawing 7 , ZC shows the frequency characteristics of the impedance ZC of Sample C. RC shows the frequency characteristics of the resistance component RC of the real part of Sample C. XC shows the frequency characteristics of the reactance component XC of the imaginary part of Sample C.
[0039] As shown in drawing 8 , ZD shows the frequency characteristics of the impedance ZD of Sample D. RD shows the frequency characteristics of the resistance component RD of the real part of Sample D. XD shows the frequency characteristics of the reactance component XD of the imaginary part of Sample D.
[0040] In drawing 5 , the impedance value in the RF field (> 50MHz) of the sample A which does not add a resistance element, and the thing which has determined about 200 ohms are involved in the frequency characteristics which the

loss factor of a NiZn ferrite has, and the configuration of a component. However, in the case of a surface mounted device, a component configuration has much constraint about a dimension, and control of the impedance characteristic of a high region frequency is not easy.

[0041] On the other hand, in the case of the sample B shown in drawing 6 , drawing 7 , and drawing 8 , Sample C, and Sample D, it was proved that the impedance value in a high-frequency field is controlled by the value of the resistance element added mostly, and the impedance characteristic in a RF field can be controlled very easily on production.

[0042] Furthermore, the conductive layer was formed in the component front face of heat treatment in reducing atmosphere from Sample C and Sample D, and it has checked further that this can use as a resistance element, and that resistance was also controllable by the conditions of heat treatment.

[0043]

[Effect of the Invention] As mentioned above, according to this invention, offer of the component which is not governed by the target value at a configuration but can control an impedance value by the specific RF field easily about the impedance component which are SMD components with much constraint, and its manufacture approach was attained about the geometry as explained. Moreover, there is an advantage of one magnetic material being able to use in common to the various component and its various manufacture approach of an impedance value, and it is very useful invention on industry.

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TECHNICAL FIELD

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PRIOR ART

[Description of the Prior Art] Generally inserting an impedance component in a serial as the technique of the cure against EMI of electronic equipment at a signal system, and intercepting a noise in recent years is performed.
[0003] Moreover, controlling that insert an impedance component in a serial and the noise of a signal system is revealed to power-source Rhine from an AKUCHIBU component also to power-source Rhine systems, such as power amplification, is also performed.
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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

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MEANS

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[Embodiment of the Invention] The gestalt of operation of this invention is explained using a drawing.
[0011] Drawing 1 shows the parallel circuit of an inductance L and Resistance R. The impedance between the terminals of this circuit is given by ** formula.
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Z=(omega2L2 R+jomegaLR 2)/(R2+omega 2L2) ..... ** [0013] the impedance component of this invention -- a ceramic paste and a conductor -- the target frequency characteristics can be acquired by carrying out the laminating of the ** paste by turns, forming a conductor in a spiral coiled form, carrying out the laminating of said ceramic paste on it, making a layered product, calcinating this layered product, forming in the front face of said layered product the coat which consists of conductive material of a resistance element, and considering as the compound device which connected this coat and the both ends of said spiral coil to juxtaposition.
[0014] When the value of the inductance L of said circuit is set to 1 microhenry or 2 microhenries and the value of the resistance R of said circuit is set to 500 ohms, the frequency characteristics of the impedance Z1 between both-ends children and the resistance component R1 of the real part, and the reactance component X1 of imaginary part are respectively shown in drawing 2 in order as a curve of A1, B1, C1, D1, E1, and F1.
[0015] The resistance R of a circuit is 500ohms and A1 shows the frequency characteristics of the impedance Z1 in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 500ohms and B1 shows the frequency characteristics of the resistance R1 of real part in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 500ohms and C1 shows the frequency characteristics of the reactance component X1 of imaginary part in case in DAKUNSU L of a circuit is 1 microhenry. The resistance R of a circuit is 500ohms and D1 shows the frequency characteristics of the impedance Z1 in case in DAKUNSU L of a circuit is 2 microhenries. The resistance R of a circuit is 500ohms and E1 shows the frequency characteristics of the resistance R1 of real part in case in DAKUNSU L of a circuit is 2 microhenries. The resistance R of a circuit is 500ohms and F1 shows the frequency characteristics of the reactance component X1 of imaginary part in case in DAKUNSU L is 2 microhenries.
[0016] When the value of the inductance L of said circuit is set to 1 microhenry or 2 microhenries and the value of the resistance R of said circuit is set to 300 ohms, the frequency characteristics of the impedance Z2 between that each child of both ends and the resistance component R2 of the real part, and the reactance component X2 of imaginary part are respectively shown in drawing 3 in order as a curve of A2, B-2, and C2, D2, E2 and F2.
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[0018] In a low frequency field, the impedance value of a coil part with a low impedance value becomes dominant, the impedance value between 2 terminals is decided so that clearly from drawing 2 and drawing 3 , but if it becomes a RF field and the impedance value of an inductance comes to exceed resistance of a circuit, the resistance component of real part will become dominant and the impedance value between 2 terminals will be converged on the value of the resistance component of real part.

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[0020] By the way, if a magnetic material like a ferrite is used for a core and an impedance component is produced, with the rise of a frequency, a reactance component will decrease and loss will increase to coincidence.

[0021] As a result, the frequency characteristics of an impedance value show change similar to the above-mentioned pure inductance L and the frequency characteristics of the parallel circuit of Resistance R.

[0022] However, when acquiring desired frequency characteristics, what controls frequency characteristics has the main loss property of an ingredient, others have few degrees of freedom at the number of turns of a spiral coil, and inductance value extent by configuration adjustment, and the target frequency characteristics are not necessarily acquired.

[0023] However, when resistance is connected to this inductance component and juxtaposition, the effectiveness by connecting with resistance and juxtaposition is shown, the component of the real part of the impedance in a RF field can control the component of the real part of an impedance, and it becomes possible to control the resistance of a RF field very easily.

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EXAMPLE

[Example] The example of this invention is explained.
[0026] The powder of a nickel-Cu ferrite was prepared as ceramic powder. This powder was blended with the binder and the solvent by the ratio of Table 1, respectively, and the ceramic paste which kneads a compound with 3 rolls and consists of an oxide magnetic material was produced.
[0027]
(表1)

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成　　分	配　合
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エチルセルロース樹脂	５重量部
エチルセルソルブ	１００重量部
テルピネオール	５０重量部

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[0029] this powder -- the ratio of Table 2 -- a binder and a solvent -- blending -- 3 rolls -- kneading -- a conductor -- the ** paste was produced.
[0030]

(表2)

導体用ペーストの配合	
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ポリビニルブチラル樹脂	２０重量部
シクロヘキサン	１００重量部
トルエン	５０重量部

[0031] Next, the laminating of the produced ceramic paste was carried out to 500 micrometers in predetermined thickness by print processes. besides -- a ceramic paste and a conductor -- using the ** paste, the spiral coil of the conductor of 3.5 turns was formed, the laminating was performed one by one, and the laminating of the ceramic paste was carried out by 300-micrometer print processes on this.
[0032] After it cut the layered product which carried out [above-mentioned] production in the predetermined dimension (2.4mmx1.5mm) and it degreased this, it was really calcinated at 950 degrees C. Drawing 4 shows the internal structure of the component which consists of this coil 1 and magnetic substance 2. The conductive paste which is mainly concerned with Ag was applied to the field which the lead section of a coil 1 has exposed, and it considered as the external terminal. The component of this condition was made into Sample A.
[0033] Next, after vapor-depositing carbon thinly on the ceramic front face between electrode terminals, what adjusted the direct current resistance between terminals to 180 ohms with the trimming equipment was made into Sample B, measuring resistance using a direct-current-resistance meter.
[0034] Moreover, about the thing in which the external terminal was formed, it put into the tube furnace and heat treatment for 700 degree-Cx 30 minutes and, and 10 minutes was performed in the hydrogen ambient atmosphere. About this sample, when the direct current resistance between terminals was measured, 480 ohms and 970-ohm resistance were checked, respectively. This was made into Samples C and D.
[0035] The frequency characteristics of the impedance of the laminating inductor produced as mentioned above were evaluated using impedance analyzer HP4191made from YHP A. The result of Sample A, Sample B, Sample C, and Sample D is shown in drawing 5 , drawing 6 , drawing 7 , and drawing 8 , respectively.
[0036] As shown in drawing 5 , ZA shows the frequency characteristics of the impedance ZA of the sample A when not adding a resistance element. RA shows the frequency characteristics of the resistance component RA of the real part of the sample A when not adding a resistance element. XA shows the frequency characteristics of the reactance component XA of the imaginary part of the sample A when not adding a resistance element.
[0037] As shown in drawing 6 , ZB shows the frequency characteristics of the impedance ZB of Sample B. RB shows the frequency characteristics of the resistance component RB of the real part of Sample B. XB shows the frequency characteristics of the reactance component XB of the imaginary part of Sample B.
[0038] As shown in drawing 7 , ZC shows the frequency characteristics of the impedance ZC of Sample C. RC shows the frequency characteristics of the resistance component RC of the real part of Sample C. XC shows the frequency characteristics of the reactance component XC of the imaginary part of Sample C.
[0039] As shown in drawing 8 , ZD shows the frequency characteristics of the impedance ZD of Sample D. RD shows the frequency characteristics of the resistance component RD of the real part of Sample D. XD shows the frequency characteristics of the reactance component XD of the imaginary part of Sample D.
[0040] In drawing 5 , the impedance value in the RF field (> 50MHz) of the sample A which does not add a resistance element, and the thing which has determined about 200 ohms are involved in the frequency characteristics which the

loss factor of a NiZn ferrite has, and the configuration of a component. However, in the case of a surface mounted device, a component configuration has much constraint about a dimension, and control of the impedance characteristic of a high region frequency is not easy.

[0041] On the other hand, in the case of the sample B shown in drawing 6 , drawing 7 , and drawing 8 , Sample C, and Sample D, it was proved that the impedance value in a high-frequency field is controlled by the value of the resistance element added mostly, and the impedance characteristic in a RF field can be controlled very easily on production.

[0042] Furthermore, the conductive layer was formed in the component front face of heat treatment in reducing atmosphere from Sample C and Sample D, and it has checked further that this can use as a resistance element, and that resistance was also controllable by the conditions of heat treatment.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing the parallel circuit which consists of an inductance L and resistance R.
[Drawing 2] Drawing showing the frequency characteristics of the impedance Z1 between that each child of both ends and the resistance component R1 of the real part, and the reactance component X1 of imaginary part when the value of the inductance L of a circuit is set to 1 microhenry or 2 microhenries and the value of resistance of a circuit is set to 500 ohms.
[Drawing 3] Drawing showing the frequency characteristics of the impedance Z2 between that each child of both ends and the resistance component R2 of the real part, and the reactance component X2 of imaginary part when the value of the inductance L of a circuit is set to 1 microhenry or 2 microhenries and the value of resistance of a circuit is set to 300 ohms.
[Drawing 4] The perspective view showing Sample A.
[Drawing 5] Drawing showing the frequency characteristics of Sample A.
[Drawing 6] Drawing showing the frequency characteristics of Sample B.
[Drawing 7] Drawing showing the frequency characteristics of Sample C.
[Drawing 8] Drawing showing the frequency characteristics of Sample D.
[Description of Notations]
1 Coil
2 Magnetic Substance

[Translation done.]